

Home Energy Saver

SCOPE OF WORK – FY2002

\$300k

September 27, 2002

Principle Investigator: Evan Mills, LBNL

The Home Energy Saver (HES) and Home Energy Advisor (HEA) are DOE's and EPA's respective web sites to help homeowners make decisions about their energy use. By better coordinating the "back-end" data and calculations used in the two tools, DOE and EPA can work together to reduce the combined costs of maintaining and improving the software engine while reducing potential user confusion caused by presence of two tools. This FY02 Scope of Work addresses these goals, and provides for user-oriented improvements to the existing HES.

LBNL will: (1) develop cost estimates for the "port" of the existing HES code (currently in Tango) to a more flexible and stable platform (Java), building on a similar recently completed port of the Home Energy Advisor code to Java; (2) create mockups for a new interface and structure with improved functionality and usability, (3) more thoroughly document the existing sites (which will facilitate programming and make the assumptions more transparent to users), (4) create a new module that helps home owners pick replacement windows, (5) and explore techniques for creating a new interface for teachers and students to learn about home energy use.

The upgraded HES site will complement the existing HEA site in a variety of ways. In particular, it will:

- Be geared for a more sophisticated consumer audience
- Serve other important audiences, such as students and teachers
- Enable the evaluation of new and emerging technologies and practices, particularly those that are the subject of R&D in DOE/BT
- Allow for evaluation of a substantially wider range of house and occupancy characteristics, and provide a more diverse set of outputs
- Address a wide range of non-ENERGY STAR technologies and measures
- Allow users the option to focus in detail on a specific end use, rather than being channeled through an entire set of house-description questions
- Provide extensive non-quantitative content as well as links to other sites
- Provide transparent and in-depth documentation of methods and assumptions

Task 1. Software Review (\$87k)

This task involves the compilation and comparison of detailed technical characteristics on a number of web- and disk-based software tools applicable to residential buildings. Given the large number of tools available, only a subset will be evaluated. Specialized as well as “whole-house” tools are to be examined and test runs made on one or two homes with actual billing data. A discussion of accuracy issues should be provided. The final report should describe “best practices” and lessons learned for future tool design.

Deliverable: Final report, downloadable from web (September 2002)

Task 2. Phase 1 of HES Port to Java and Interface Redesign (\$62k)

The aim of the Task is to create an updated version of the Home Energy Saver site with improved usability and performance, while activating selected features (e.g. ranked retrofits) found in the Home Energy Advisor. This will involve “porting” the existing HES site to Java.

The Task will take place in three Phases, the first of which is funded in FY02

- A. Scoping & Functional Spec. Clarifies and refines the design of the site (functional specification) and cross linkages to HEA, and provides a cost estimate for Tasks 2B and 2C.
- B. Technical Spec. Develop a technical specification that serves as a highly detailed blueprint for subsequent programming efforts.
- C. Programming of Merged Site: Incorporate unique HES features into the Java code already developed for the Home Energy Advisor site.

Task 2A will be completed under the current Scope of Work. Based on DOE approval of the cost estimate produced under this task, the merger can subsequently be completed (Tasks 2B & 2C).

Subtasks & Deliverables: to be completed by 31 December 2002

- 2a. Work by LBNL staff to explore the various potential levels of coordination between the HES and HEA sites, ranging from common elements of the back-end engine and data to cross-linkages between two independent sites to an entirely merged site. Mockups to be provided to DOE for review and comment.
- 2b. Identify those features present in HES that need to be ported to Java in order to build upon the Java port of HEA performed FY02, identify areas that need further thought to produce pseudo-code (retrofit set, modeling process, etc.).
- 2c. Identify areas in the HEA port code that need to be modified to incorporate HES features and planned improvements (e.g. change water heater to use vintage-based efficiency factors, CW and DW retrofit modeling).

- 2d. Clarify thinking about technical features in the ported HES site (expansion of retrofit set, general process for retrofit to be modeled, changes to cost structure for retrofits). This does not include creation of the actual business logic for the above, nor incorporating the new HVAC upgrades (Task 3) into the web interface – these are tasks for FY03
- 2e. Subcontractor provides cost estimate for remaining work for completion of HES port (technical specification and programming).

Task 3. Document Modeling Assumptions, Algorithms, and Data (\$88k)

This task will provide documentation of various modeling assumptions, algorithms, and data utilized throughout the site, as well as user-oriented distillations to be incorporated on-line.

The following documentation will be produced:

- Technical report on DOE-2 simulation methodology
- Technical report on HES calculation methods and data
- On-line documentation of calculation methods

Consideration of HVAC modeling will also involve an assessment of the feasibility and logical timing of an eventual transition from DOE-2 to EnergyPlus as the engine.

Deliverables: Documentation to be completed by 31 December 2002. Periodic memo reports on the EnergyPlus question.

Task 4. Create New HVAC Features and Outputs (\$85k)

Develop and document improved methods of modeling HVAC energy use and building features. These will be implemented in On-line version under the FY2003 funding cycle.

- Add weather locations
- Update effective foundation U-factors
 - Update construction material properties
- Add insulation degradation options
- Add optimum value engineered framing options
- Add insulated header options
- Consider allowing user to specify wall construction per side of house
- Add door types
- Allow user to specify door U-factor as an alternative to door type
- Update window/skylight U-factors and SHGCs
- Add window/skylight types
- Allow user to specify window/skylight U-factor and SHGC as an alternative to window/skylight type
- Add attic radiant barrier options

- Update roof absorptances
- Add roof color options
- Allow user to specify roof absorptance as an alternative to roof color
- Update modeling of garages as buffers
- Allow user to specify house blower door test result as an alternative to qualitative house air-tightness
- Incorporate FSEC duct performance function into DOE-2 code
- Add gas heat pump option
- Add HVAC system sizing option
- Add monthly consumption option
- Testing/commissioning of existing and new HVAC modeling

Deliverables: Technical work to be completed by September 30, 2002; testing/commissioning to be completed by December 2002.

Task 5. Create a Window-Selection Decision Tree (16k)

Coordinate with ongoing research in the DOE Windows Program to create a web page that would quickly point consumers to window retrofit products most appropriate to their problems, house type, budget, desired lifetime for the retrofit, and climate. Consumers would be able to focus only on windows without having to answer irrelevant questions about the house in the web tool.

Deliverables: Schedule linked to that of core project currently funded by Sam Taylor.

Task 6. Energized Learning (12k)

Coordinate with LBL's Center for Science and Engineering Education to explore how teachers and students would use the Home Energy Saver to learn about home energy use. *Energized Learning* deploys a new educational interface with student projects involving household- and community-scale data gathering and analysis. Using the website as a "virtual laboratory", students analyze their home's energy use and savings opportunities. *Energized Learning's* engages students in "real science", i.e., acquiring and applying scientific information while incorporating a range of disciplines and learning skills spanning Visual Arts, Earth Sciences; Probability and Statistics, Investigation and Experimentation, plus Microeconomics and web-based communications. Mastery of the subject will also equip students to use the tool in vocational settings, e.g., as energy auditors in School-to-Work programs.

Deliverables: Memo report on how specialized interfaces for specialized audiences within the core software tool would work: October 2002. On-line prototype of the site available by December 2002.